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Efficiency in Swine Production

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The survival of any swine operation depends on the emphasis placed in those areas that are responsive to management. A listing of the more important would include:

1. Genetic Potential
2. Reproductive Efficiency
3. Feeding Programs
4. Ration Formulation to Lower Cost of Gains
5. Ration Preparation (processing)
6. Feed Wastage
7. Method of Feeding
8. Environment
9. Health of Herd
10. Marketing Weights

All are critical to production efficiency and need careful consideration on a year-round basis.

It is not possible to give consideration to all 10 areas of importance here today. Emphasis will be given to those that are most critical to the breeding herd--Genetic Potential, Reproductive Efficiency and Feeding Programs.

Genetic Potential

Efficiency of swine production includes all phases of the life cycle. Heredity and environment provide a contributing influence in all of these different phases. The most excellent environment will not allow individual animals to perform better than their hereditary potential. The best of heredity is of little value unless a suitable environment is supplied to allow individuals to approach their genetic limit. Any method of production that increases the amount of marketable lean per unit of feed consumed increases the efficiency of production. A sow that produces nine pigs produces each pig more efficiently than one that weans five. Pigs that produce a pound of gain on less feed than others with a larger percentage of the carcass as lean influence efficiency.

Selecting and mating the best to the best for those important traits is one way of improving efficiency of production. Selection is a slow process and is most effective for improving the highly heritable traits. Swine producers are fortunate, however, because those traits that are most important to them are also medium to high in heritability. Consequently, if a recommended selection program is followed, progress can generally be expected.

Data at the South Dakota testing station during the period from 1958 to 1975 show that performance change in South Dakota herds has taken place. These data are comparable to those found at other stations.

	1958-59 (3 test periods)	1970-71 (3 test periods)	1973-75 (3 test periods)
Average daily gain, lb.	1.86	1.95	2.01
Feed/cwt gain, lb.	3.06	2.83	2.49
Live back fat probe, in.	1.13	0.92	0.96[a]
Loin eye area, sq. in.	4.26	4.62	5.65[a]

[a]Back fat and loin eye readings made with use of ultrasound equipment--boars only. Prior to this period loin eye data shown were for barrows (carcass) which were included with a test pen of boars.

Reproductive Efficiency

Increasing the number of pigs raised per sow per year is the goal for all swine producers. Research and field trials have pointed out specific management practices that give improved reproductive efficiency. Some of the more important include:

1. Conception rate--A gestating or lactating female requires about the same amount of feed, space and labor regardless of the litter size she is gestating or nursing. An open sow usually receives the same amount of feed, space and labor as a pregnant sow. For example, if a fixed number of 40 litters was to be farrowed, then 45 sows would have to be exposed if a 90% conception rate was to be obtained. If only an 80% conception rate was obtained, 50 sows would be required. Present feed costs place emphasis on the importance of high conception rate for each sow serviced.

2. Select and keep the high producing female. Ratio of sows and gilts should favor sows insofar as possible. Enough gilts must be brought continuously into the production herd to make sure farrowing stalls are kept filled.

Sows normally ovulate more eggs and farrow larger litters than gilts. They are easier to work with if weight is kept down and have higher conception rates. Sows are generally more resistant to stress and problem organisms that are evident in swine facilities.

3. New gilts coming into the herd should be activated by some environmental influence near the time of expected puberty or time of mating. Gilts reared in confinement are often reported to be slow to reach puberty. Gilts held in confinement for breeding periods may stop showing heat after puberty is reached. Current theories suggest that the lack of environmental stimuli can interfere with physiological development and normal reproduction. Gilts delayed in reaching puberty can often be environmentally stimulated to initiate or resume normal cycling.

Research and practical experience have shown that several environmental factors can stimulate noncycling gilts to cycle. The stimulation may also cause estrus synchronization. Heat in gilts nearing the age of puberty can be stimulated and synchronized by exposure to a boar, provided gilts have not had prior contact with a boar. "Transport phenomenon" refers to the tendency of groups of gilts to come into heat simultaneously soon after being transported from one farm to another. Although not substantiated by research, variations of this phenomenon have been adapted to aid the stimulation of estrus in young gilts and recylcing in older gilts. These variations include mixing pens of gilts, loading and hauling around the section, fluctuating temperature and humidity in enclosed structures and radically changing the feeding program.

4. Pig losses before and after birth--Much work has been done to try to identify the factors responsible for causing embryo mortality, which is estimated to be as high as 30% of the eggs ovulated. Exposing bred gilts to two hours of heat stress (approximately 100° F) daily from 2 to 13 days after breeding had no effect on the pregnancy rate at 45 days, whereas the same exposure from 14 to 25 days of gestation reduced pregnancy by 33% (8 of 12 animals). Embryonic mortality was increased by 26.5% in gilts stressed prior to day 13 and about the same (approximately 33%) for gilts stressed after day 13 when compared to unstressed gilts.

Research from Canada indicates that two factors have a bearing on survival, (1) birth weight and (2) whether the pig is born first or last in the litter. These two factors are probably related, in that the biggest pigs as well as those born earliest have the greatest chance of getting a good feed of colostrum. Although not referred to directly, no direct relationship has been shown in other research between survival to weaning and either of these factors. Work currently in progress at the University of Illinois hopes to shed new light on the problem of whether to allow free access to colostrum from the time of birth or to hold off the piglets until all of them are born.

5. Crossbreeding for more and heavier pigs per litter--The majority of all hogs produced in South Dakota are crossbred. The three-breed rotational cross is perhaps the most widely used crossbreeding system. In this system boars of three different breeds are continually rotated in succession on each generation of crossbred sows produced in the program. It is a continuous rotation of boars from three breeds, mating the gilts and sows in each generation to boars of the breed farthest removed in their pedigree. It is rather simple to follow and, since all sows and pigs are crossbred, it should yield heterosis in litter size, livability and growth rate.

Base the choice of breeds to include in rotational breeding on availability of tested boars and knowledge of how the various crosses perform. If you have no experience involving various crosses, remember that breeds that perform best as purebreds will generally produce the highest performing crossbreds.

Over 85% of hogs are crossbreds--One of the main reasons often given for using a crossbreeding program for commercial pork production is that crossbred sows, on the average, raise larger litters than straightbred (purebred) sows. A recent Oklahoma study indicates that crossbred pigs also have a greater survival rate than purebreds. In this study, 26 purebred litters of the Duroc, Hampshire or Yorkshire breeds were compared with 59 crossbred litters representing all possible two-way crosses of these three breeds. All sows were purebred and all crossbreds were sired by a purebred boar of another breed.

At 42 days of age, the average number of pigs per litter was 6.1 for the purebred and 7.4 for the crossbred. The average litter weight was 144 lb. for the purebred and 177 lb. for the crossbred. The data also indicated that there was more advantage in using a boar of another breed on purebred Duroc or Hampshire gilts than on Yorkshire gilts.

Select crossbred gilts for greater ovulation rate, litter size and weaning weight. Select those that are healthy, have received needed nutrient requirements, maintained in an average to cool environment with adequate pen space and which have fence-line contact with a boar after they are moved from the finishing unit.

6. Optimum time to breed--breeding twice--The estrus cycle lasts for about 60 hours. The optimum time to breed to get maximum litter size and conception rate is between the 22nd and 44th hour after the onset of estrus. Ovulation occurs at about 30 to 40 hours after the beginning of estrus which falls in the middle of this period.

Breeding 12 to 24 hours after the beginning of estrus and again 12 to 24 hours later has increased conception rate by 10% and litter size by 1.3 pigs.

7. Wean at 3 to 5 weeks. If you are the good manager with good facilities, 3-week weaning may be in more favor than 5-week weaning. Five-week weaning may fit your program especially if management or pig comfort is not always adequate.

8. Rebreed sows on the first post-estrus rather than the second. While farrowing rate is reduced for sows mated on the first post-weaning estrus as compared with those mated on the second, average litter size is not significantly different. Therefore, first estrus mating after weaning actually may reduce the number of days to produce pigs. The goal from weaning to farrowing should be 117 to 118 days.

Some points to consider when rebreeding are:

1. No feed or water first day after weaning may help.

2. Individual penning before and until 15 days after breeding to reduce stress and embryonic mortality. Pen sows in as small a group as is practically possible.

3. The odor, sound and sight of the boar hastens estrus and increases conception rate.

Feeding Programs

Feed represents the major cost of producing swine. The amount will vary from 65 to 75% of the total cost for finishing swine down to around 50% for feeder pigs (based on 15 pigs produced per sow per year). Anything that can be done to reduce feed costs without sacrificing production will improve the economic picture for the swine producer.

Research shows that we can reduce the amount of feed being fed to brood sows by use of alternate feeding programs without affecting reproductive performance. A swine producer's goal should be to "meet the nutrient requirements of the sow at the least cost with satisfactory litter size and pig survival rate." Factors which influence meeting the goal are:

1. Feed consumption (equipment needs)
2. Labor needs
3. Economical ration
4. Feed supply

Restricting the amount of energy a pregnant sow consumes during gestation has been accepted as a very desirable management practice. Libal and Wahlstrom (1974) at the South Dakota Station reported that a total of 124 sows were utilized in three trials (two summer and one winter) to evaluate metabolizable energy levels of 4000, 5000, 6000 and 7000 Kcal for sows during gestation. The metabolizable energy level of 6000 Kcal appears to be nearly optimum for gestation weight gain, litter size and average pig birth weight and litter and average pig weaning weight. Sow weight change during lactation is directly related to sow weight gain during gestation. Sows gaining the most during gestation gained less or lost weight during lactation. The energy level fed had an effect on number of live pigs born. Larger litters were obtained with lower energy levels. The diets and feeding levels used are shown in table 1.

Table 1. Composition of Experimental Diets (Percent) and Feeding Levels

Ingredient	Gestation diet	Lactation diet
Ground yellow corn	54.5	68.5
Soybean meal, 44%	31.0	--
Soybean meal, 48.5%	--	18.5
Dehydrated alfalfa meal, 17%	10.0	--
Ground beet pulp	--	10.0
Dicalcium phosphate	1.8	2.0
Ground limestone	1.2	0.8
Trace mineralized salt	0.5	0.5
Vitamin premix	1.0	0.2
	100.0	100.0

Gestation Feeding Levels[a]

Gestation diet, lb.	3.0	3.0	3.0	3.0
Corn starch, lb.	--	0.7	1.4	2.1
Total feed/day, lb.	3.0	3.7	4.4	5.1
ME, Kcal/day	4000	5000	6000	7000

[a]Provided 280 g protein, 15 g calcium, 10 g phosphorus, 8200 IU vitamin A, 550 IU vitamin D, 3 IU vitamin E, 44 mg niacin, 33 mg calcium pantothenate, 8 mg riboflavin and 28 mcg vitamin B_{12} daily.

Libal and Wahlstrom at the South Dakota Station reported on the "Effects of Interval Feeding Two Types of Gestation Rations on Reproductive Performance of Sows and Gilts" (Swine Field Day, 1969). Using the interval feeding method, two hours per day on Monday, Wednesday and Friday, 46 sows and 44 first litter gilts were fed two different gestation diets differing in energy content. High energy and bulky diets contained 1443 and 1083 calories of metabolizable energy per pound of feed, respectively. In both trials, sows receiving the high energy diet gained more weight during gestation and farrowed more live pigs. During the winter trial no difference in feed consumption due to treatment was observed. However, in the summer trial sows receiving the high energy diet consumed more feed daily than those receiving the bulky diet.

Results from the gilts were considerably different than those of the sows, indicating possible differences in requirements under these conditions. During both trials gilts consumed about 30% more of the high energy diet than of the bulky diet. However, in the winter trial these gilts actually lost weight while those eating less of the bulky diet gained weight. During the summer trial both groups gained weight with those fed the high energy diet gaining the most. In both trials more live pigs were farrowed by the gilts receiving the bulky diet.

Svajgr (1968) at the Nebraska Station reported that sows and gilts could be fed 2 hours out of 72 during gestation with good reproductive performance. Data showed the gilts ate about the same amount of feed whether they were fed daily or for only 2 hours every three days. Thus, feed costs were not reduced by the interval feeding system but labor was saved. Reproductive performance was excellent for both groups. One word of caution, interval feeding demands that each animal have access to adequate feeder space at the time of feeding.

Danielson (1974, 1975) at the North Platte Station, University of Nebraska, has clearly demonstrated with several studies that the brood sow can reproduce well on diets made up largely of alfalfa hay or prairie hay plus minerals and vitamins.

Reproductive performance of gilts fed 25% to 96.75% alfalfa hay or prairie hay appeared to be satisfactory. It was pointed out in this trial that some depression in reproductive performance resulted when the diet contained 25% dehydrated alfalfa meal. The gilts in this lot gained over 100 pounds during gestation and it was reported that they may have been too fat coming into the farrowing house.

McMullen and Moser (1975) also showed that gilts fed a diet consisting of pelleted whole corn plant plus minerals and vitamins gave satisfactory reproductive performance with gilts when compared to gilts fed a 14% normal corn-soybean meal diet. However, gilts fed opaque-2 (high-lysine) corn, minerals and vitamins showed better reproductive performance than those fed the whole corn plant pellet or the 14% normal-soybean meal diet.

Jones, Mayrose and Foster (AS 408, 1973, Purdue University, Indiana) reported on four feeding systems (individual feeding stalls, interval feeding, group feeding and pasture system) for gestating sows. Individual stalls provide the best control over feed intake but may require more labor.